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(54) SCREW AIR COMPRESSOR FOR A WELDER

(75) Inventors: **Herbert A. Bankstahl**, Appleton, WI (US); **Joseph Gitter**, New London, WI (US)

(73) Assignee: **Illinois Tool Works Inc.**, Glenview, IL (US)

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(65) **Prior Publication Data**

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(51) **Int. Cl.**[7] **B23K 9/10**; H05B 7/11
(52) **U.S. Cl.** .... **219/133**; 290/1 A
(58) **Field of Search** .... 219/133, 134; 290/1 A, 1 R

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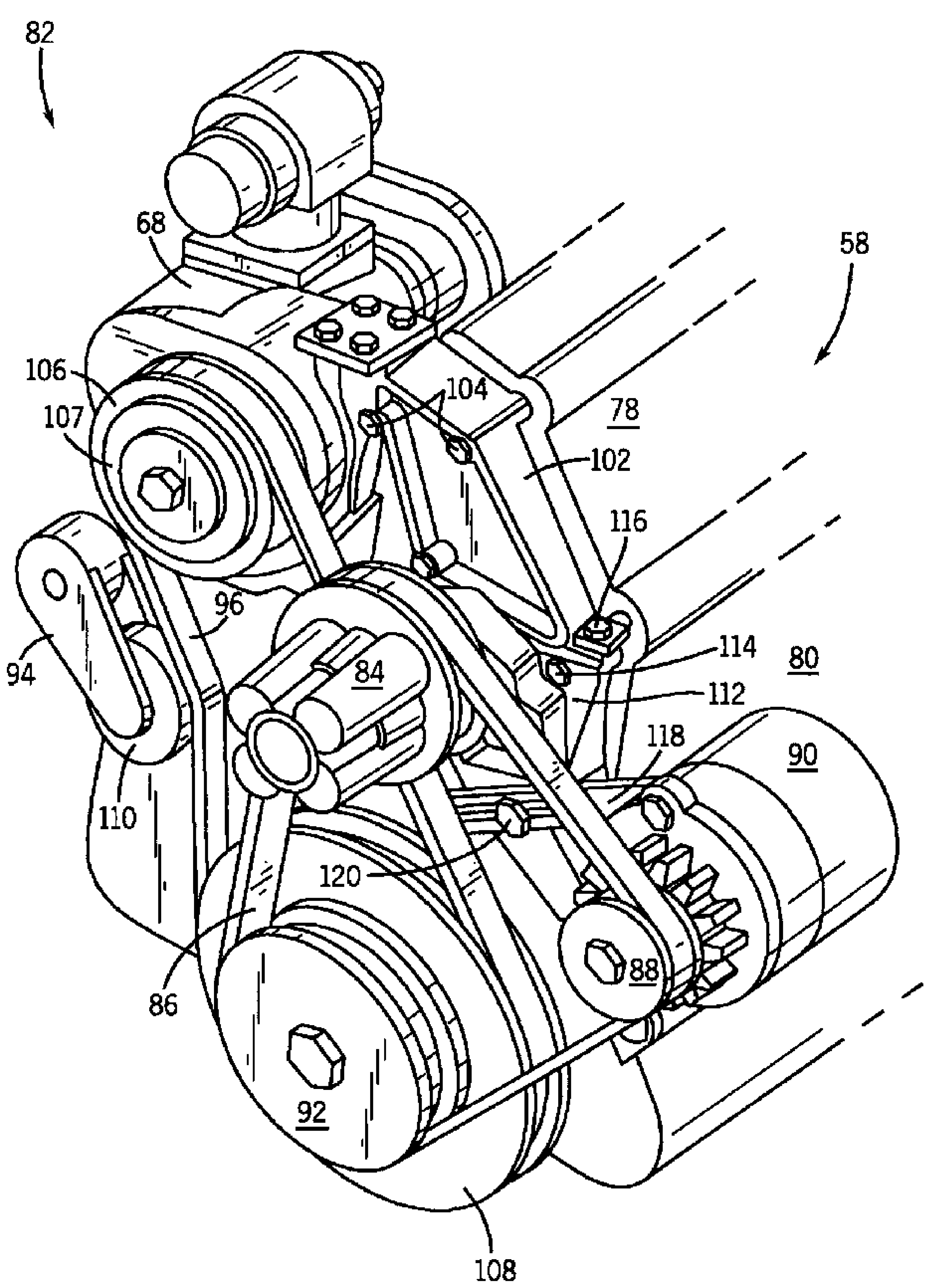
Primary Examiner—M. Alexandra Elve
Assistant Examiner—Kevin McHenry
(74) *Attorney, Agent, or Firm*—Ziolkowski Patent Solutions Group, LLC

(57) **ABSTRACT**

A portable and fully integrated welder and compressor combination includes a housing having an engine, electrical current generating alternator, and a belt-driven screw air compressor. The engine is configured to drive the generator directly, and a pulley arrangement is provided on the engine to drive the belt-driven screw air compressor.

33 Claims, 8 Drawing Sheets



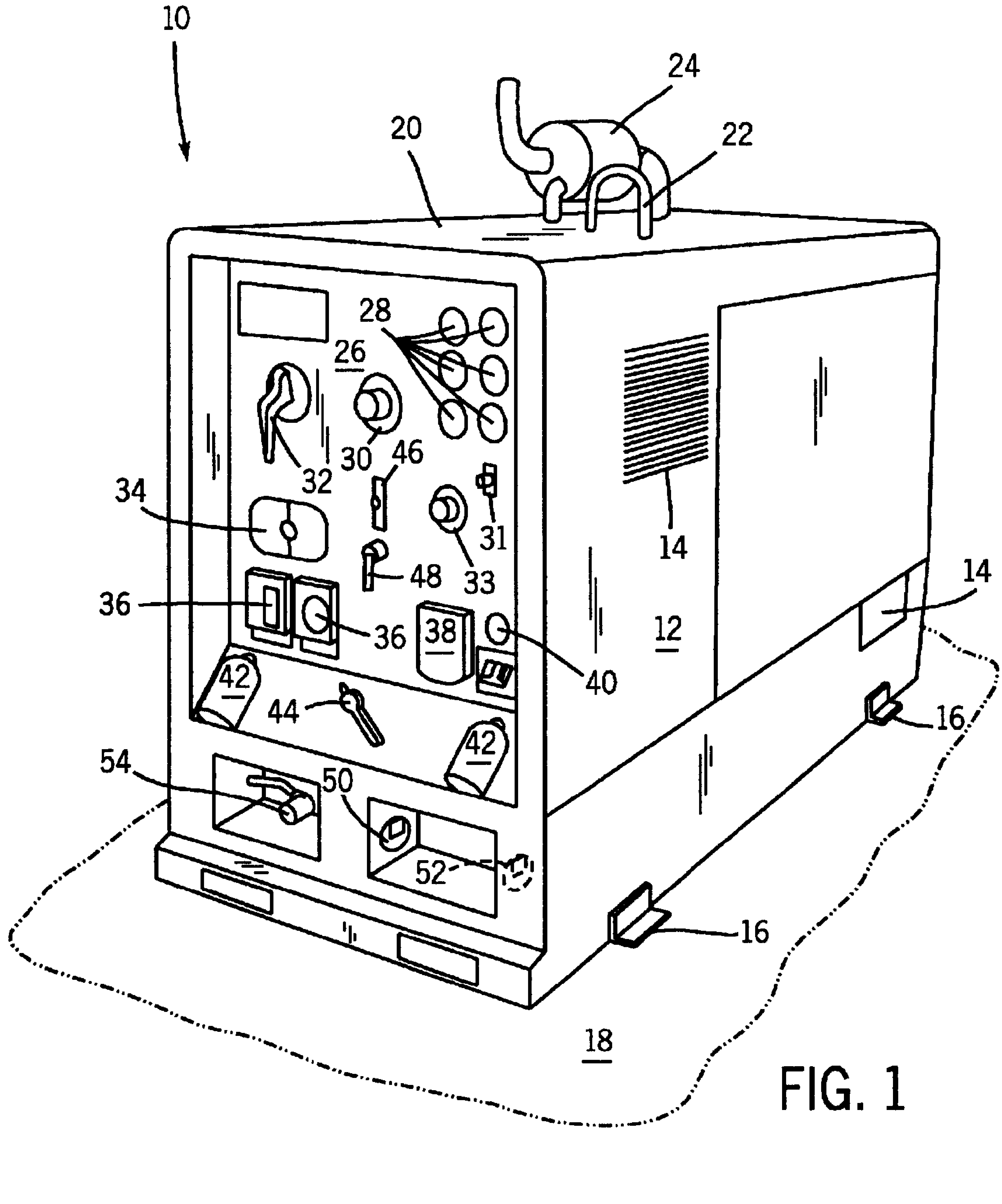

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FIG. 1

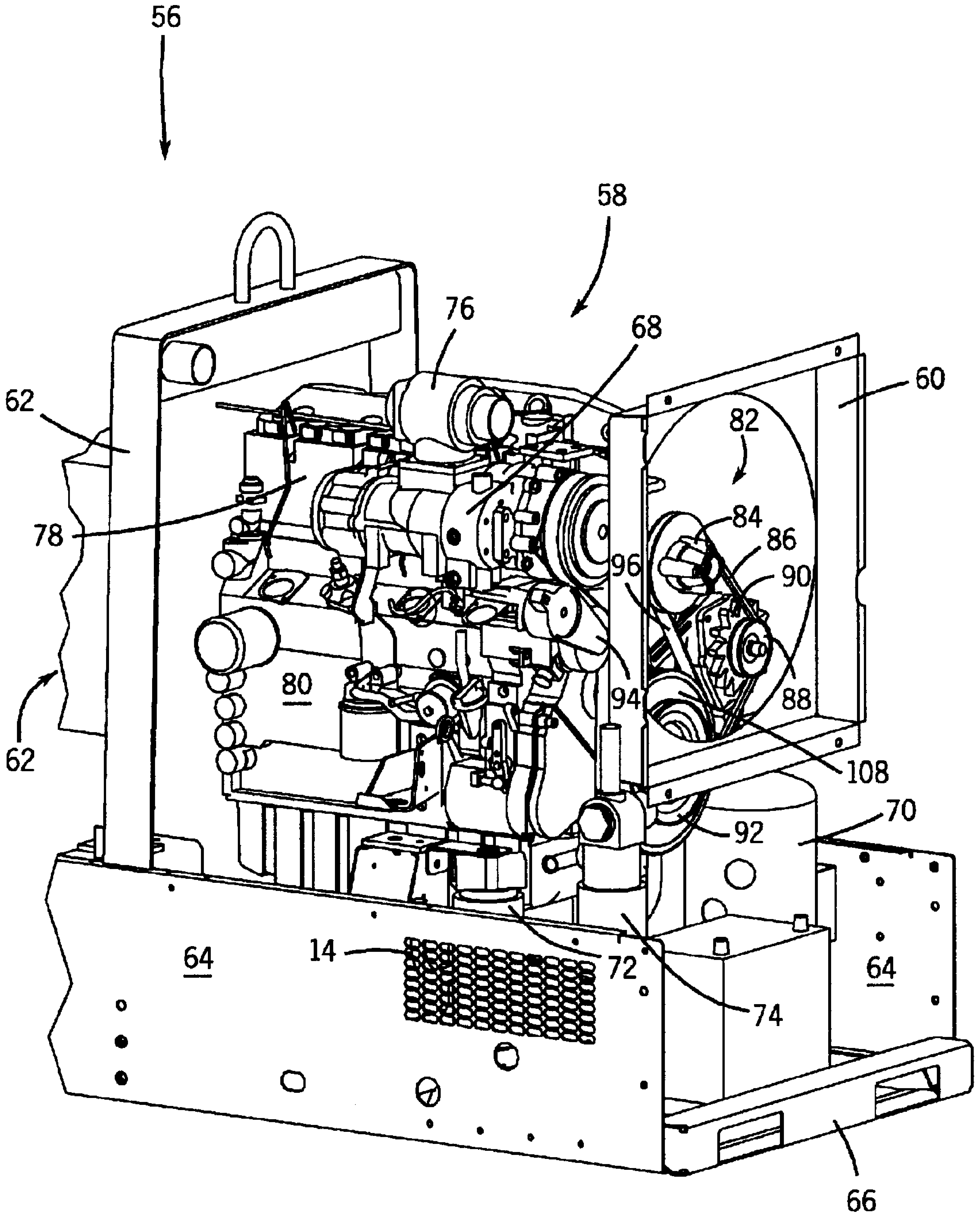
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FIG. 2

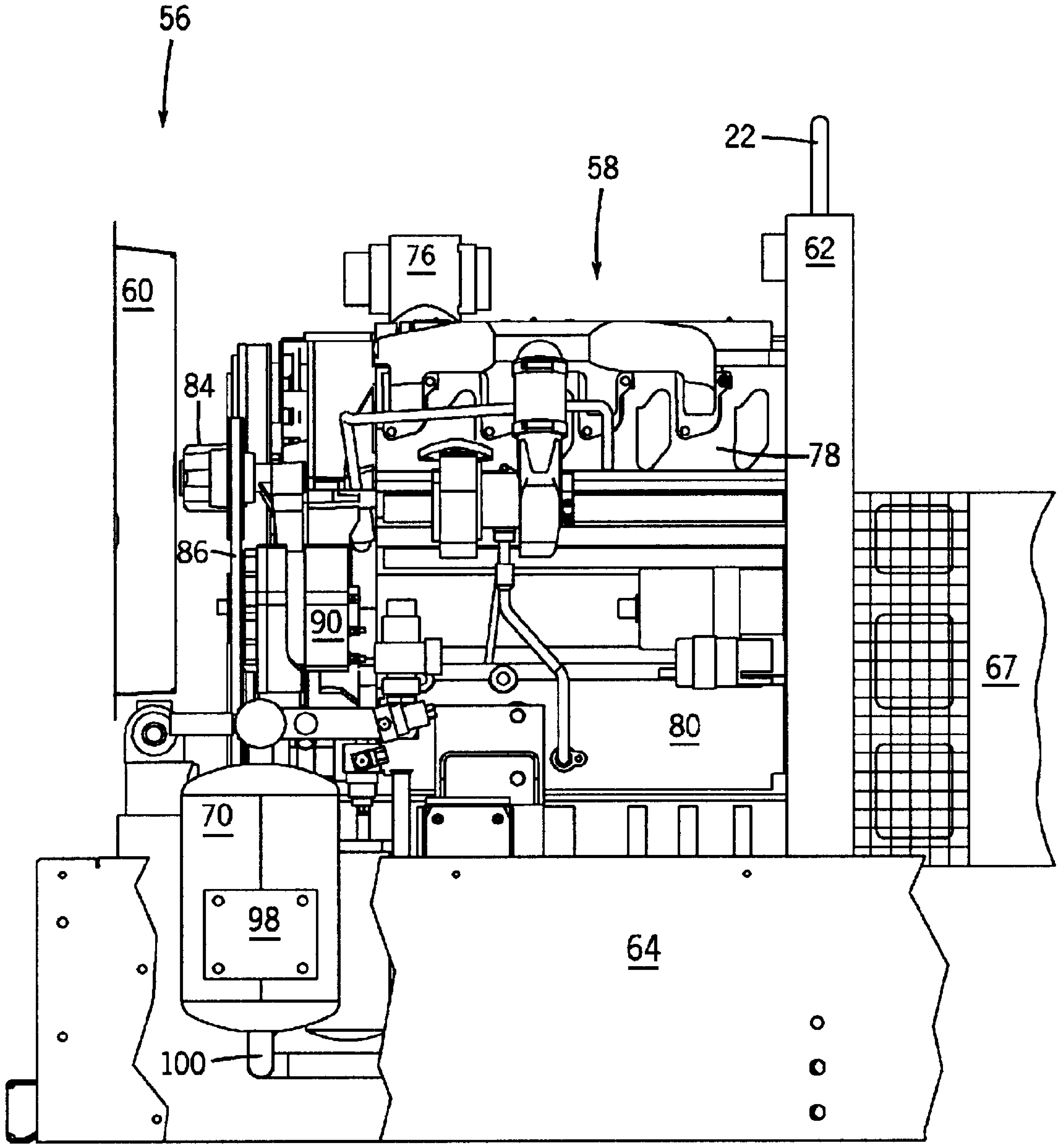

FIG. 2A

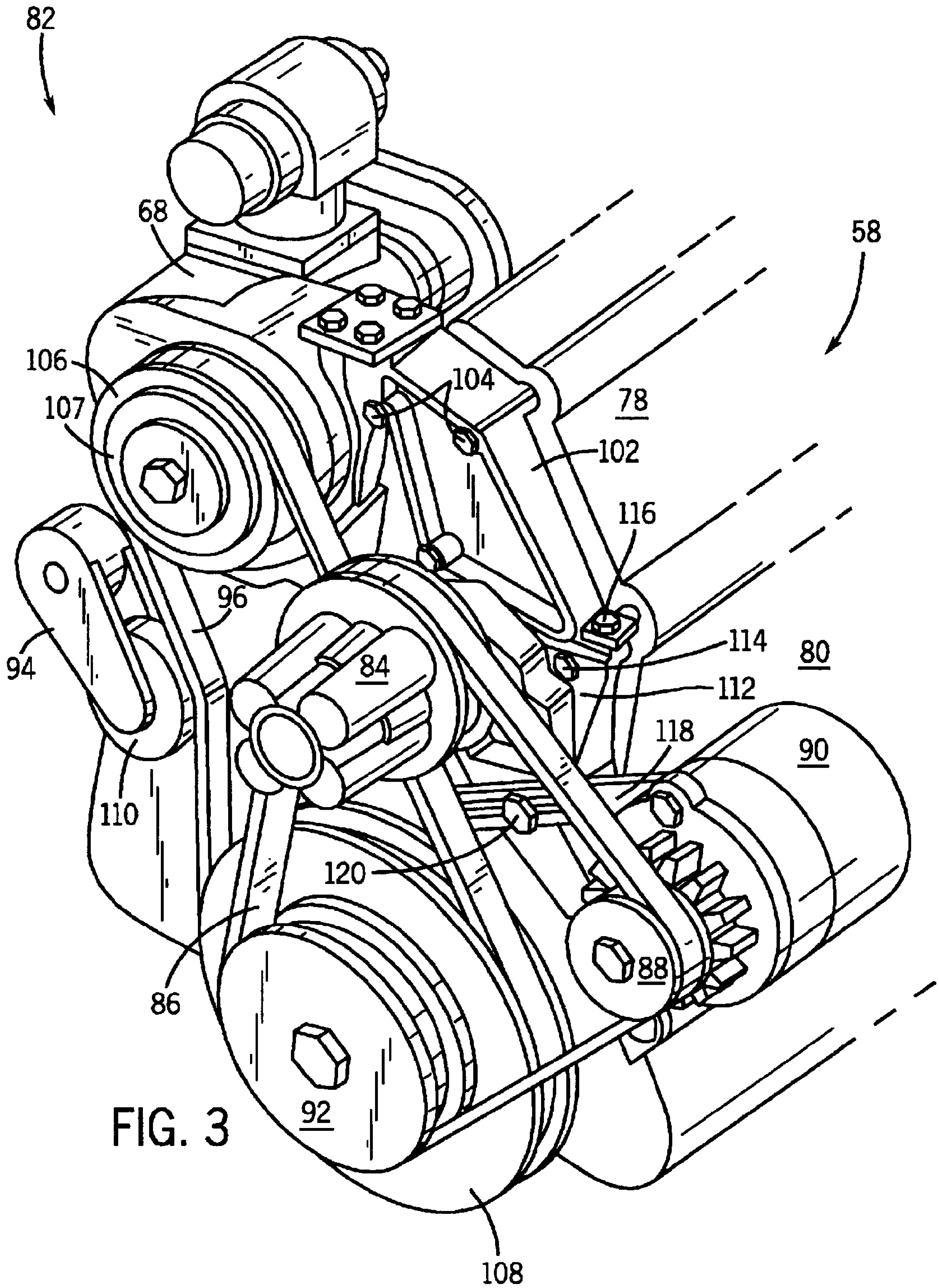
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FIG. 3

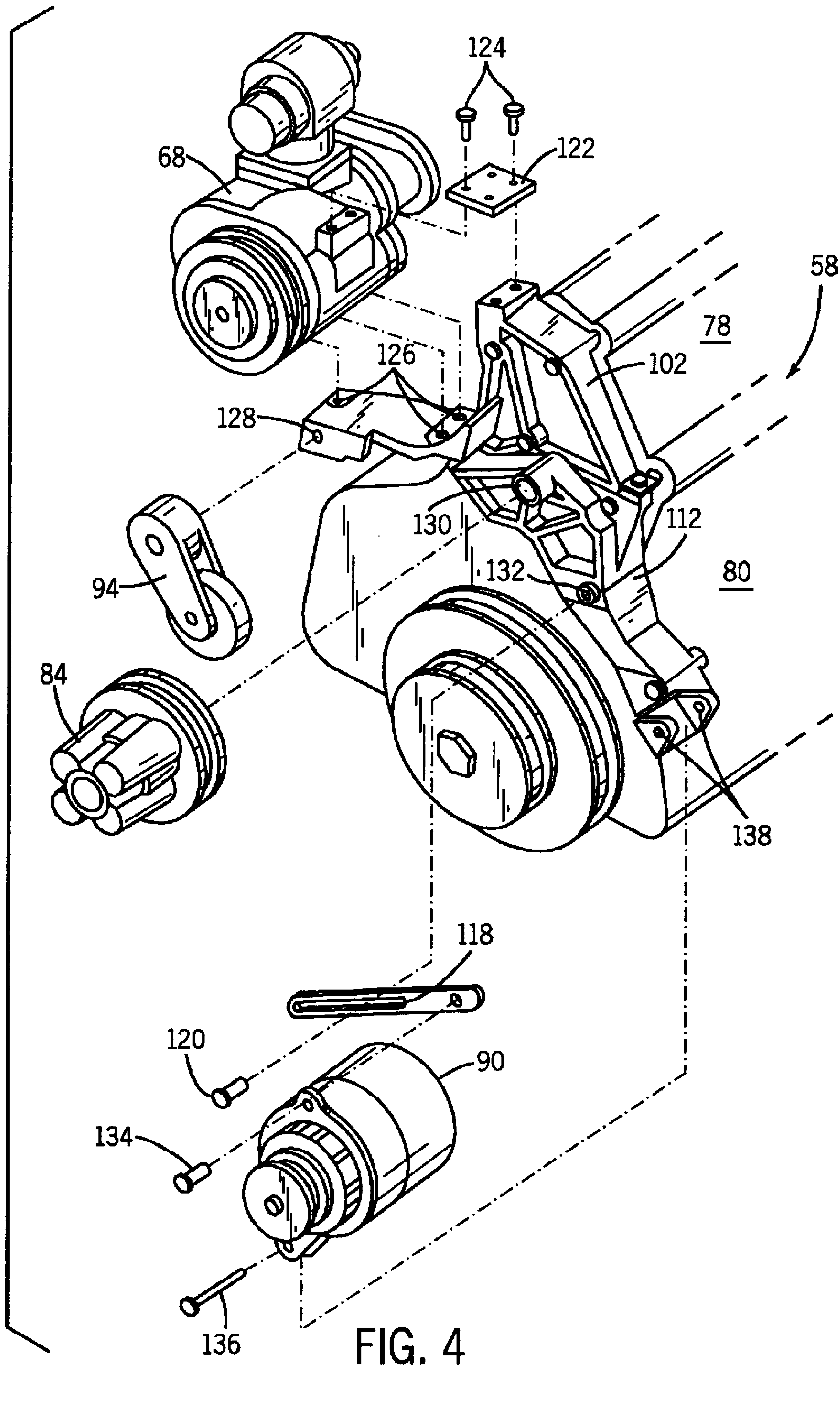
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FIG. 4

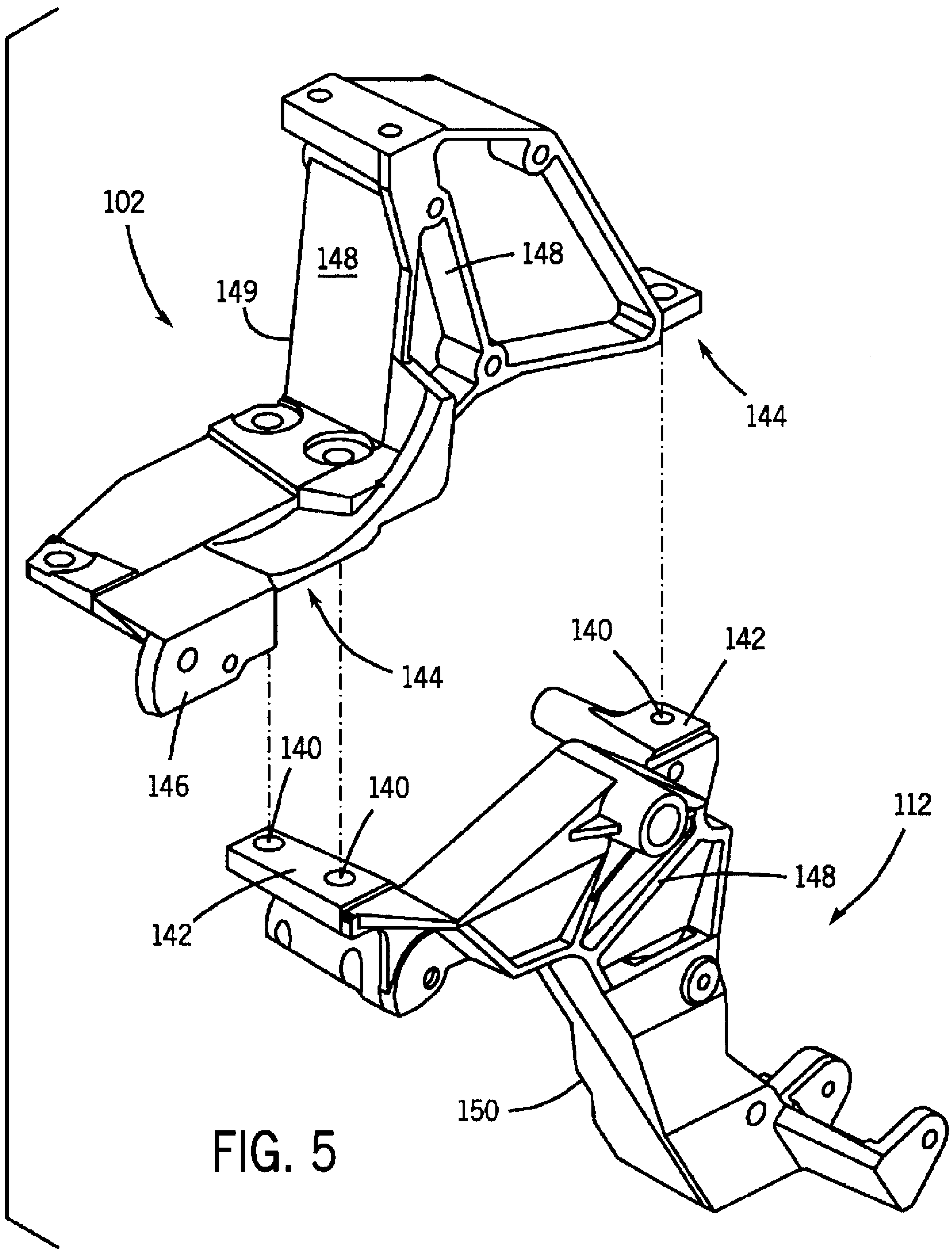

FIG. 5

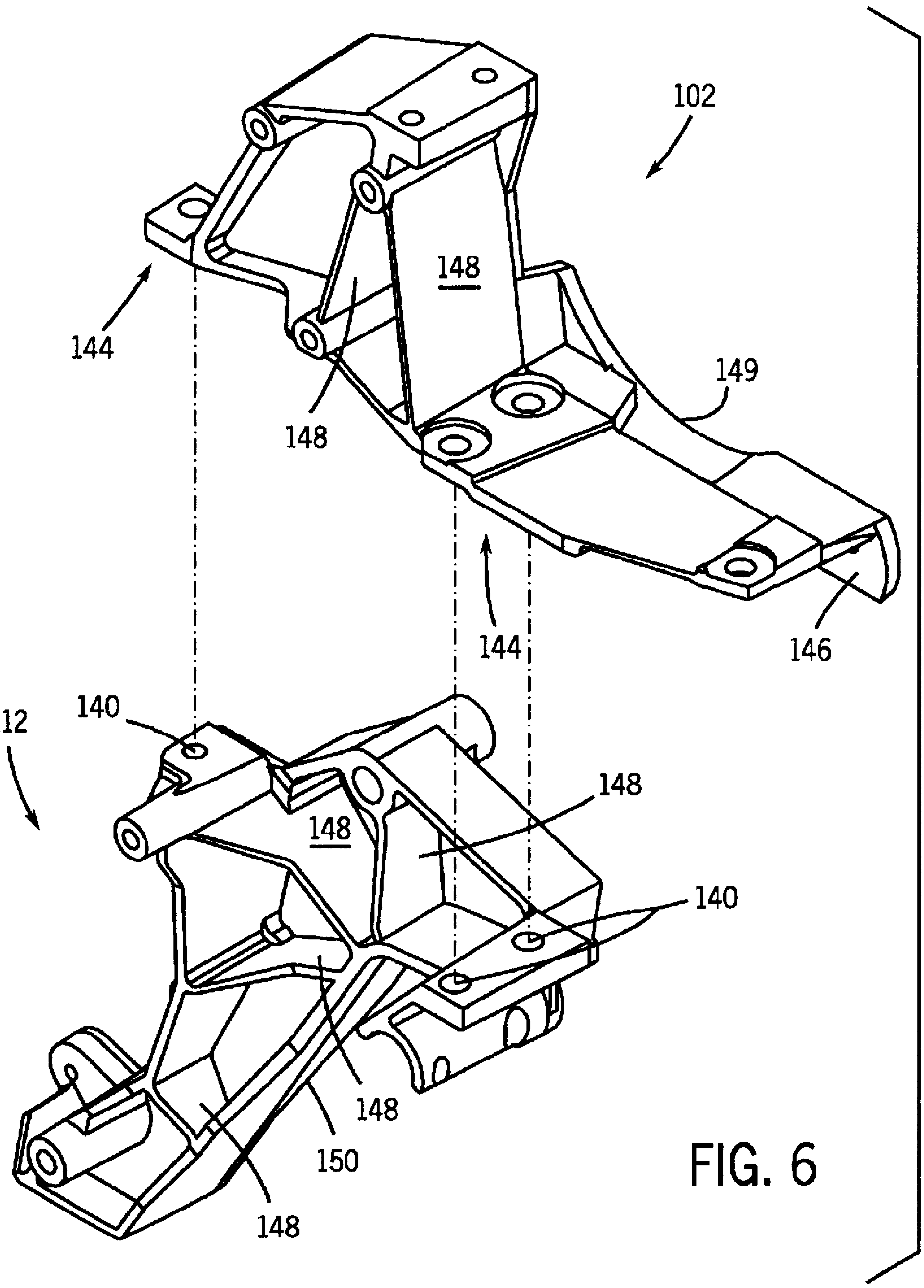

FIG. 6

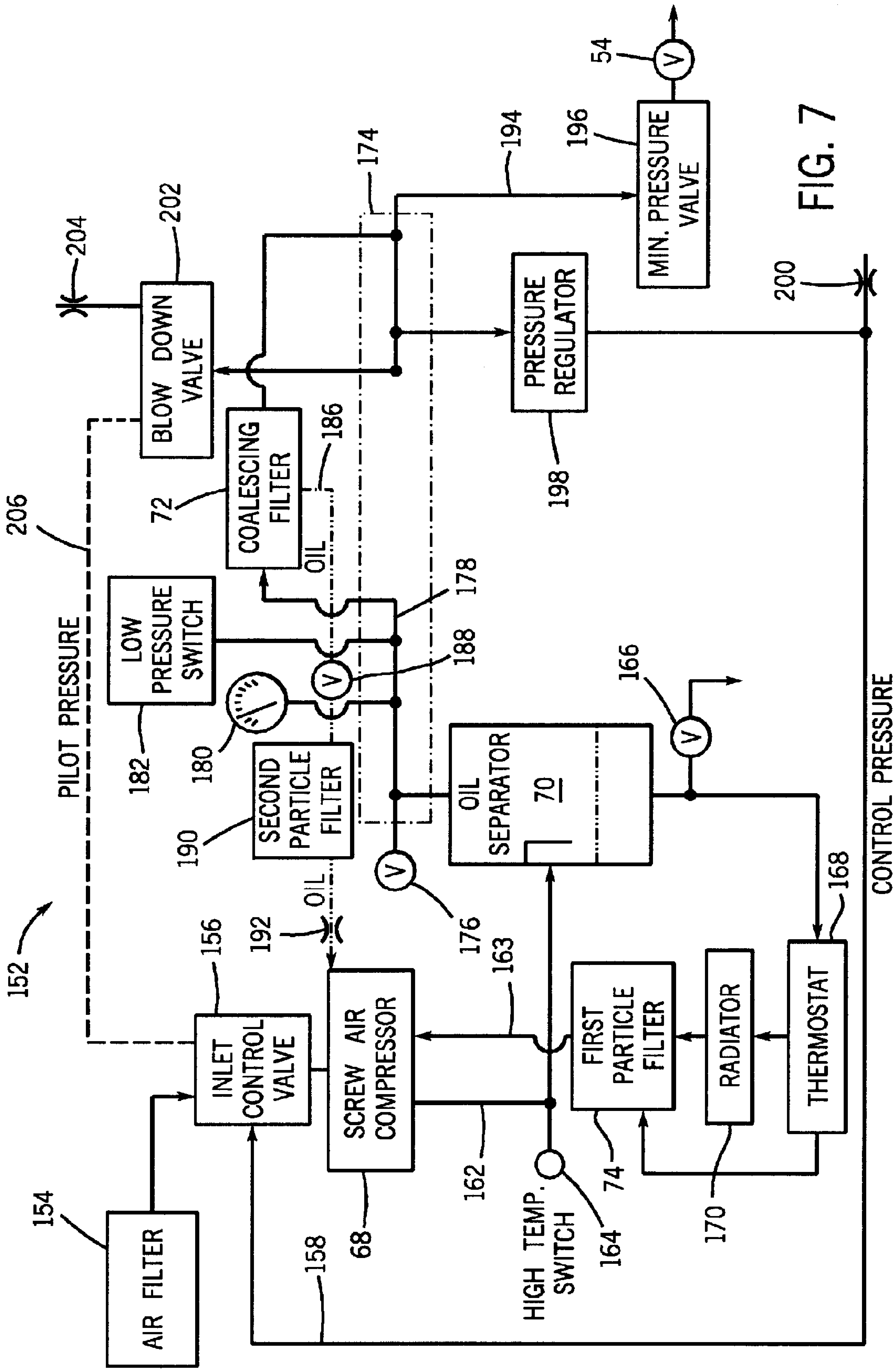
AIR FILTER
154
INLET CONTROL VALVE
156
158
SCREW AIR COMPRESSOR
68
162
163
HIGH TEMP. SWITCH
164
FIRST PARTICLE FILTER
74
RADIATOR
170
THERMOSTAT
168
CONTROL PRESSURE
OIL SEPARATOR
70
166
176
192
OIL
SECOND PARTICLE FILTER
190
180
LOW PRESSURE SWITCH
182
188
178
COALESCING FILTER
72
OIL
186
174
BLOW DOWN VALVE
202
204
PILOT PRESSURE
206
152
PRESSURE REGULATOR
198
200
MIN. PRESSURE VALVE
196
194
54

FIG. 7

SCREW AIR COMPRESSOR FOR A WELDER

BACKGROUND OF INVENTION

The present invention relates generally to combined welder and compressor units, and more particularly to a unit of this type having a belt-driven screw air compressor configured to provide compressed air for pneumatic operations.

Portable welding and compressor units transportable to a work site are known. Typical known units include a lightweight frame consisting of metal tubing on which is mounted an internal combustion engine that is directly connected to a generator which generates an amperage to operate the unit or welder. The generator further provides auxiliary alternating current for operating auxiliary equipment, such as an air compressor. The air compressor provides compressed air for pneumatic equipment as well as certain welding applications, such as operating a plasma cutting torch. Other known portable welding and compressor units include an engine, alternator, compressor, and air tank assembly mounted within a housing along an extended length of the housing.

While combined welder and compressor units operate satisfactorily, they have several disadvantages. First, such systems tend to be bulky and/or heavy. In a typical unit, a welder may weigh approximately 2000 pounds and have a separate compressor unit adding approximately 1500 pounds. Transporting such systems to various work sites is difficult and time consuming. Second, known welder and compressor units incorporate air compressors that have high rates of mechanical breakdowns. Moreover, air compressors are often positioned within the welding unit, and in instances of air compressor breakdown, associated repair costs and welding unit downtime may be substantial.

There is a need for a welder and compressor unit or combination that has improved portability and durability. It would therefore be desirable to have a more lightweight and efficient air compressor than current air compressors, that can be externally mounted to an internal combustion engine for rapid repair and replacement.

BRIEF DESCRIPTION OF INVENTION

The present invention is directed to an improved welder and compressor combination to supply compressed air and electrical current for pneumatic and arc welding operations to overcome the aforementioned concerns.

The invention includes a portable welder having an internal screw air compressor. Screw air compressors are generally more durable than reciprocating air compressors used with known devices and have additional desired characteristics that include low initial cost, compact size, and low weight. Further, a screw air compressor, especially one belt driven by an engine as in the present invention, is easy to repair and maintain which is desirable in portable equipment. In addition to a screw air compressor, the present invention also includes an engine mounted within a housing of the welder which provides power to an electric current generator for generating the electrical current used during welding operations. The engine has a pulley arrangement connected by belts that drive the screw air compressor, an alternator, and an engine cooling fan. Further included is a clutch assembly connected to the screw air compressor that controls the screw air compressor which provides compressed air for pneumatic operations.

In accordance with one aspect of the present invention, a welder and compressor combination includes a transportable housing having an engine mounted therein. An electrical generator is also mounted within the housing and driven by the engine, and provides an arc welding current for use in welding operations. The welding and compressor combination further includes a screw air compressor that provides compressed air as needed. The screw air compressor is preferably mounted to the engine to permit rapid installation during manufacture and removal for replacement or repair of the screw air compressor as may be needed. The screw air compressor also includes a clutch assembly driven by a belt in operable association with the engine. The clutch assembly engages or disengages the screw air compressor from the engine.

In accordance with another aspect of the present invention, an engine-driven welder combination is disclosed and includes a welder housing having internal components mounted thereto. An engine is also mounted within the welder housing, and has an electrical generator and screw air compressor connected thereto. The engine rotates the electrical generator to produce an arc welding current for welding operations. The screw air compressor provides compressed air for air-driven tools. The screw air compressor has a disengageable drive pulley connected to the engine and is mounted on the engine. The screw air compressor is externally mounted to the engine in such a fashion to allow easy installation and provide quick removal for servicing.

In accordance with yet another aspect of the present invention, a welding and air compression system includes a means for compressing air having at least one screw-type means rotatable in a longitudinal cylinder to generate compressed air, and a means for generating an arc welding current. A means for driving the air compressing means is provided along with a means for generating an arc welding current. Examples of such means include an internal combustion engine configured to drive an electric generator and a screw air compressor. The welding and air compression system further includes a means for connecting air to the means for driving, and a means for regulating the means for compressing air.

Various other features, objects and advantages of the present invention will be made apparent from the following detailed description and the drawings.

BRIEF DESCRIPTION OF DRAWINGS

The drawings illustrate one preferred embodiment presently contemplated for carrying out the invention.

In the drawings:

FIG. **1** is a perspective view of a welder and compressor combination incorporating the present invention.

FIG. **2** is a perspective view of a portion of the welder and compressor combination with a housing cover removed.

FIG. **2A** is a side view of the welder and compressor combination of FIG. **2**.

FIG. **3** is a perspective view of a portion of an engine showing a pulley arrangement of the welding and compressor combination of FIG. **2**.

FIG. **4** is an exploded view of FIG. **3** without the belts for driving the pulley arrangement.

FIG. **5** is a front perspective view of a pair of mounting brackets shown in FIG. **4**.

FIG. **6** is a rear perspective view of the pair of mounting brackets of FIG. **5**.

FIG. **7** is a schematic of the screw air compressor air and oil routing system incorporated in the combination of FIG. **1**.

DETAILED DESCRIPTION

Referring now to FIG. **1**, a portable engine-driven welding and compressor combination or system **10** is provided. The welder combination **10** has an outer housing **12** that has one or more air vents **14** for cooling internal components of the welder combination **10**. The housing **12** can be easily removed to permit access to the internal components for maintenance and service. A plurality of support members **16** provide stabilization for the welder combination **10** when placed on a generally level surface, such as surface **18**. An upper surface **20** of the welder combination **10** includes a lifting hook **22** extending therethrough for lifting and transporting of the welder combination **10**. Also attached to the upper surface **20** is an exhaust system **24** that lowers noise and removes exhaust gas from the welder combination **10**.

The welder combination **10** includes a control panel **26** that has various control elements and gauges for operating the welder combination **10**. A plurality of gauges **28** measure various parameters of the welder combination **10**. Measured parameters can include oil pressure, fuel level, oil temperature, battery amperage, air pressure, and engine running time of the welder combination **10**. Control panel **26** also has a control dial **30** and an ampere range switch **32** which are used to select a voltage/amperage for welding operations. Process selector switch **34** selects the type of weld output. The weld output is determined by the type of welding process. Examples of weld processes that may be implemented include stick welding, TIG welding, air-carbon arc cutting, and various wire feed processes. Electrical outlets **36** provide power for electrically driven devices, such as saws, drills, etc. Control panel **26** also includes a compressor on/off switch **31** and an engine control switch **33** to independently control the compressor and engine, respectively.

The control panel **26** also includes multiple power connections such as single phase power connect **38**, optional three-phase power connect **40**, and weld-power receptacles **42**. An optional polarity switch **44** can be used to select the polarity of the weld output. Typical selections include direct current electrode negative, direct current electrode positive, and alternating current. A panel remote switch **46** and remote receptacle **48** select remote control of the welder combination **10** in instances where welding operations are remotely located from the welder combination **10**. Positive **50** and negative **52** battery charge connections are used for battery jumpstart or charging, and are positioned adjacent to a system output or shut-off valve **54**. Upon engaging of the compressor clutch and opening of valve **54**, compressed air is supplied for air assisted carbon arc cutting or to air driven power tools and other pneumatic operations.

Referring now to FIG. **2**, a perspective view of a portion **56** of the welder combination **10** of FIG. **1** is shown with the housing cover **12** removed. An internal combustion engine **58** is mounted to a frame assembly **64** between a radiator shroud **60** and a lifting hook support member **62**. The engine **58**, in a preferred embodiment, is oil cooled and configured to recirculate engine cooling oil. The lifting hook support member **62** secures to the frame assembly **64** for structural support during lifting of the welder combination **10**. The frame assembly **64** has air vents **14** that permit air flow through the welder combination **10** to cool the internal components. Cross-brace **66** provides structural support for the frame assembly **64**. An electrical generator **67** configured to generate an arc welding current is mounted within the housing **12** of the welder combination **10** and driven by the engine **58**. The welder combination further includes a screw air compressor **68** mounted to the engine **58** that is configured to provide compressed air to the shut-off valve **54** of FIG. **1**. The screw air compressor **68** is fluidly connected to an oil separator **70**, a coalescing filter **72**, which combine to separate oil from an air/oil mixture and a first particle oil filter.

The internal combustion engine **58** of the welder combination **10** includes an air intake connected to an intake manifold and engine head **78**. The engine head **78** is mounted to an engine block **80**, which collectively form the engine **58**. A pulley arrangement **82** is bolted to both the engine head **78** and the engine block **80** and includes a fan blade hub **84** rotated by a first drive belt **86**, such as a serpentine belt. The first drive belt **86** further connects to an alternator pulley **88** that drives an alternator **90** by a first crankshaft pulley **92**. A belt tensioner **94** connects to a mounting bracket **78** to maintain tension on a second drive belt **96** that drives the screw air compressor **68** driven by a second crankshaft pulley **108**.

Referring now to FIG. **2**A, a side view of the portion **56** of FIG. **2** is shown. Frame assembly **64** connects to support member **62** which is attached to lifting hook **22**. The internal combustion engine **58** is shown having fan blade hub **84** attached to the engine head **78** as previously discussed with reference to FIG. **2**. A fan (not shown) is attached to fan blade hub **84** that is housed in the radiator shroud **60**. Engine block **80** has alternator **90** mounted thereto which is driven by the first drive belt **86**. The electrical generator **67** mounts to the engine block **80** and is rotated by the engine **58** to generate the arc welding current used in welding operations. Oil separator **70** is mounted to the frame assembly **64** with a mounting plate **98**. An oil return line **100** of the oil separator **70** connects the oil separator **70** to the radiator, as will be described with reference to FIG. **7**. An air intake **76** is provided to supply air to the screw air compressor **68**.

FIG. **3** is a perspective view of the pulley arrangement **82** connected to the engine head **78** and the engine block **80**. The screw air compressor **68** bolts to a first mounting bracket **102** that is connected to the engine head **78** via bolts **104**. The screw air compressor pulley **106** of the pulley arrangement **82** is driven by the second drive belt **96** which in turn is driven by the second crankshaft pulley **108**. The screw air compressor **68** is controlled by a clutch assembly **107** which is connected to air compressor pulley **106**. Preferably, the clutch assembly **107** is a magnetic clutch assembly. Tension on the second drive belt **96** is maintained by a roller **110** of the belt tensioner **94**.

A second mounting bracket **112** is mounted to the engine block **80** via a set of bolts **114**, and is connected to the first mounting bracket **102** via bolts **116** to attach the pulley arrangement **82** to the engine **58**. The fan blade hub **84** is secured to the second mounting bracket **112**, and is driven by the first drive belt **86**. The first drive belt **86** also drives alternator pulley **88** and is driven by first crankshaft pulley **92** of the pulley arrangement **82**. Also included is an adjustable slide linkage **118** that has bolt **120** which connects to the second mounting bracket **12** to position the alternator **90** and provide tension to first drive belt **86**. That is, the alternator **90** can be repositioned according to the position of bolt **120** along the adjustable slide linkage **118** to provide more or less tension on the first drive belt **86**.

Referring now to FIG. **4**, an exploded view of FIG. **3** showing the connections of the components to one another without the first and second drive belts **86, 96** is shown. The pulley arrangement **82** includes a mounting plate **122** for connecting the screw air compressor **68** to the first mounting bracket **102** via bolts **124**. Bolt holes **126** are used to attach the screw air compressor **68** to the first mounting bracket **102**. Belt tensioner **94** is connected to the first mounting bracket **102** at bolt hole **128** with an appropriate fastener. The fan blade hub **84** is rotatably secured to the second mounting bracket **112** with a bolt through bolt hole **130**. Bolt hole **132** permits connection of the adjustable slide linkage **118** to the second mounting bracket **112**. Bolt **134** connects the slide likage to the alternator **90**. The alternator **90** is also connected to the second mounting bracket **112** by bolt **136** which passes through a pair of bolt holes **138**. The first and second mounting brackets **102, 112** are preferably attached to the engine **58** in such a manner as to not interfere with the connection between the cylinder head **78** and engine block **80**. That is, by mounting first bracket **102** to the cylinder head **78** and mounting the second bracket to the block **80**, and then bolting the first mounting bracket **102** to the second mounting bracket **112**, the seal between the cylinder head **78** and block **80** is not compromised.

FIGS. **5** and **6** show respective front and rear views of the first **102** and second **112** mounting brackets. The first mounting bracket **102** is configured to connect the screw air compressor to the engine such that a longitudinal length of the screw air compressor is aligned with a longitudinal length of the engine. The second mounting bracket **112** includes bolt holes **140** configured to permit connecting of the first mounting bracket **102** to the second mounting bracket **112**. The second mounting bracket **112** also has contact surfaces **142** configured to fit smoothly against lower surfaces **144** of the first mounting bracket **102**. Surface **146** is used to mount and align belt tensioner **94**. The first and second mounting brackets **102, 112** also include bracket stiffeners **148** that add structural strength. Preferably, a backside **149** of the first mounting bracket **102** is contoured to the shape of the cylinder head **78** and a backside **150** of the second mounting bracket **112** is contoured to the shape of the engine block **80** to provide maximum support for the screw air compressor **68**.

Referring now to FIG. **7**, a schematic of the compressor air and oil routing system **152** is provided. The compressor system **152** includes an air filter **154** that directs ambient air to an inlet control valve **156**. Air pressure along line **158** controls the inlet control valve **156**, which regulates air flow into the screw air compressor **68** of FIG. **2**. The screw air compressor **68** provides a compressed air/oil mixture along line **162** to the oil separator **70**. A high temperature switch **164** monitors the temperature of the air/oil mixture and is configured to open a contact (not shown) to disable the magnetic clutch assembly **107** of FIG. **3** if the temperature exceeds a predetermined limit. After passing through the oil separator **70**, oil exits the oil separator **70** and enter a cooling system that includes a thermostat **168** and a radiator **170**. A manually controlled drain valve **166** is supplied to drain oil from the oil separator **70**. The radiator **170** acts as a dual purpose radiator having two cooling chambers. One of the two chambers cools compressor oil and the other chamber cools engine coolant by circulating engine oil therethrough. Collectively, the oil separator **70**, first particle filter **74**, thermostat **168**, and radiator **170** form a compressor oil cooler assembly capable of reducing the temperature of the filtered oil that returns to the screw air compressor **68** along line **163**.

The thermostat **168** includes a control valve that directs oil to either the radiator **170** or the first particle filter **74**. When oil is selected by the control valve to pass through the radiator **170**, it also passes through the first particle filter **74** after flowing though the radiator **170**. After passing through the first particle filter **74**, the oil enters the screw air compressor **68**. The air, including a small amount of remaining oil mist, exiting from the oil separator **70** flows through a system that includes a distribution manifold **174** and a safety valve **176** for limiting pressure in line **178**. Air pressure gauge **180** is provided to monitor line **178**. A low pressure switch **182** is also connected to line **178** to prevent restart of the compressor **68** until pressure in the manifold **174** has reached a minimum value.

After entering the manifold **174**, the air/oil mixture from line **178** flows through a coalescing filter **72**. Oil is routed along line **186** through a one-way valve **188** and a second particle filter **190**. After passing through the second particle filter **190**, the oil passes through an orifice **192** which regulates flow to the screw air compressor **68**. Air exiting from the coalescing filter **72** is delivered to a minimum pressure valve **196** by line **194**. If the pressure along line **194** is sufficient, air will pass through the minimum pressure valve **196** to the shut-off valve **54** of FIG. **1**, which provides compressed air for pneumatic operations of the welder combination **10**. Using air received from the coalescing filter **72**, a pressure regulator **198** regulates air pressure along control pressure line **158** in conjunction with a bleed orifice **200**. Pressure in line **158** controls the position of inlet control valve **156**. Air can also pass from the coalescing filter **72** into a blow-down valve **202** and exit the compressor system **152** through bleed down orifice **204**. Depending on the pilot pressure at **206**, air flow either increases or decreases through the bleed orifice **204** depending on the position of the inlet control valve **156**.

In accordance with one aspect of the present invention, a welder and compressor combination includes a transportable housing and an engine mounted within the transportable housing. The welder and compressor combination also includes an electrical generator configured to generate an arc-welding current. The electrical generator is mounted within the transportable housing and driven by the engine. The welder and compressor combination further includes a screw air-compressor having a clutch assembly driven by a belt in operable association with the engine.

In accordance with another aspect of the present invention, an engine-driven welder combination includes a welder housing having internal components mounted thereto, such as an engine. The portable engine-driven welder combination further includes an electrical generator connected to and rotated by the engine to generate an arc-welding current. In addition to the electrical generator, a screw air compressor is mounted to the engine. The screw air compressor has a disengageable drive pulley connected to the engine and is mounted on the engine.

In yet another aspect of the present invention, a welding and air compression system includes a means for compressing air to generate compressed air and a means for generating an arc-welding current. The means for compressing air has at least one screw-type means in a longitudinal cylinder. The welding and air compression system also includes a means for driving the means for compressing air and the means for generating an arc-welding current, and a means for connecting the means for compressing air to the means for driving. The welding and air compression system further includes a means for regulating the means for compressing air.

In another alternative embodiment, the screw air compressor could equivalently be driven from the generator end of the portable engine driven welding and compressor combination. That is, the drive shaft from the engine can extend through the generator to allow a belt pulley to be attached thereto and drive a screw air compressor mounted to the generator.

The present invention has been described in terms of the preferred embodiment, and it is recognized that equivalents, alternatives, and modifications, aside from those expressly stated, are possible and within the scope of the appending claims.

What is claimed is:

1. A welder and compressor combination comprising:

a transportable housing;

an engine mounted within the transportable housing;

an electrical generator configured to generate an arc welding current, the electrical generator mounted within the transportable housing and driven by the engine; and

a screw air compressor having a clutch assembly driven by the engine.

2. The combination of claim **1** further comprising a belt in operable association and driven by the engine to drive the screw air compressor and an oil separator tank connected to the screw air compressor to separate oil from compressed air.

3. The combination of claim **1** further comprising an air filter configured to filter air to the screw air compressor and to supply air to a system output.

4. The combination of claim **3** further including a compressor oil cooler assembly connected to the screw air compressor and capable of reducing a temperature of compressor oil.

5. The combination of claim **4** wherein the compressor oil cooler assembly includes a dual purpose radiator having two cooling chambers, where one chamber cools compressor oil and a second chamber cools engine coolant.

6. The combination of claim **5** wherein the engine is an oil cooled engine that recirculates engine cooling oil in a cooling system and in a lubrication system and the second chamber of the radiator circulates engine oil therethrough.

7. The combination of claim **1** further including an inlet control valve pressure regulated and connected to control the flow of air in the screw air compressor.

8. The combination of claim **1** wherein the clutch assembly is a magnetic clutch assembly.

9. The combination of claim **1** further comprising a first mounting bracket connecting the screw air compressor to the engine such that a longitudinal length of the screw air compressor is aligned with a longitudinal length of the engine.

10. The combination of claim **9** wherein the first mounting bracket is bolted to only one of an engine block and an engine head.

11. The combination of claim **10** further comprising a second mounting bracket bolted to the first mounting bracket and wherein the second mounting bracket is bolted to only one of the engine block and the engine head.

12. The combination of claim **11** wherein the first mounting bracket is bolted to the engine head and the screw air compressor, and the second mounting bracket is bolted to the first mounting bracket and the engine block.

13. The combination of claim **11** further comprising an alternator have an adjustable slide linkage connected thereto, the alternator mounted to an end of the second mounting bracket opposite of an end bolted to the first mounting bracket.

14. The combination of claim **9** further comprising a belt tensioner mounted to the first mounting bracket.

15. The combination of claim **13** further comprising a fan hub connected to the second mounting bracket, the fan hub rotated by a first belt.

16. An engine driven welder combination comprising:

a welder housing having internal components mounted thereto;

an engine mounted within the welder housing;

an electrical generator rotated by the engine to generate an arc welding current; and

a screw air compressor having a disengageable drive pulley connected to be driven by the engine and wherein the screw air compressor is mounted on one of the engine and the electrical generator.

17. The engine driven welder combination of claim **16** further comprising a pulley arrangement mounted to the engine and a belt drivingly connecting the screw air compressor to the engine via the pulley arrangement.

18. The engine driven welder combination of claim **16** further comprising a first mounting bracket and a second mounting bracket, wherein each of the first and second mounting brackets are connected to only one of an engine block and an engine head.

19. The engine driven welder combination of claim **18** wherein the first and second mounting brackets are connected to one another.

20. The engine driven welder combination of claim **18** wherein the first mounting bracket supports the screw air compressor.

21. The engine driven welder combination of claim **16** further comprising a system manifold connected to a coalescing filter configured to separate an air and oil mixture from the screw air compressor.

22. The engine driven welder combination of claim **21** further comprising a shut-off valve exterior to the welder housing and configured to receive filtered air for use with air-assisted tools.

23. The engine driven welder combination of claim **16** further including a magnetic clutch assembly configured to regulate operation of the screw air compressor.

24. The engine driven welder combination of claim **23** wherein an inlet control valve connects to the screw air compressor to regulate air flow therethrough.

25. The engine driven welder combination of claim **16** wherein the screw air compressor is mounted by at least one bracket to the engine such that the disengageable drive pulley of the screw air compressor is coplanar with a crankshaft pulley of the engine.

26. A welding and air compression system comprising:

means for compressing air having at least one screw-type means in a longitudinal cylinder to generate compressed air;

means for generating an arc welding current;

means for driving both the means for compressing air and the means for generating an arc welding current;

means for connecting the air compressing means to the means for driving; and

means for controlling the air compressing means.

27. The welding and air compression system of claim **26** further comprising a means for separating an air and oil mixture generated by the air compressing means.

28. The welding and air compression system of claim **27** further comprising a means for cooling compressor oil.

29. The welding and air compression system of claim **26** wherein the means for compressing air is a screw air compressor.

30. The welding and air compression system of claim **26** wherein the means for generating an arc welding current includes an engine driven generator.

31. The welding and air compression system of claim **26** wherein the means for connecting includes a first mounting bracket and a second mounting bracket connected to one another.

32. The welding and air compression system of claim **26** wherein the means for driving includes an engine capable of receiving an externally mounted belt-driven screw air compressor.

33. The welding and air compression system of claim **26** wherein the means for controlling the means for compressing air is a magnetic clutch assembly.

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